Switch modules for handsets

Skyworks Solutions Inc. has expanded its family of Gallium Arsenide (GaAs) switch products with the addition of two new highly integrated antenna switch modules designed for next-generation cellular handsets.

Antenna switch modules perform transmit and receive switching as well as band switching while filtering power amplifier (PA) harmonics, and are a key component in reducing a handset's system complexity. Skyworks' AM107-602 and AM108-603 switch modules are designed to support all key wireless standards as well as the stringent cost and small-size requirements of global handset manufacturers. Both of the new modules are based on the company's low temperature co-fired ceramics (LTCC) technology, obtained through the acquisition of Aimta Inc. earlier this year. LTCC improves system integration levels, enhances performance and increases user talk time.

David Fryklund, Skyworks' vice president of switch and control products commented: "Our multi-chip module expertise in GaAs PHEMT, silicon decoder ICs and now LTCC, allows our customers to shrink board space, reduce power consumption and simplify handset design."

AM107-602

Skyworks' new AM107-602 is a Gallium Arsenide (GaAs)-based dual-band antenna switch module, operating on the enhanced global standard for mobile communications (E-GSM) 900 and digital cellular system (DCS) 1800 bands. This module was designed to provide an alternative to PIN diode-based products and offers improved insertion loss and lower current drain in all conditions leading to increased handset talk time. During transmit mode this solution will draw 5 microamps (μA), while a typical PIN diode module draws 5 to 10 milliamps (mA). Additional features of the new module include integrated SP2T GaAs switches, a decoder for two-line control, low-pass transmit filters and diplexer. Packaged in a 12-pin 5.4mm x 4.0mm x 1.6mm land grid array (LGA) module, the AM107-602 is the one of the industry's smallest antenna switches.

AM108-603

Skyworks' AM108-603 is a tri-band GaAs-based antenna switch module operating on the GSM 900, DCS 1800 and PCS 1900 bands. This module offers comparable insertion loss and lower current drain in all states (typical less than 5 uA in receive), relative to competing products. The AM108-603 offers an integrated decoder chip that allows the handset designer to choose from a variety of switching topologies. For example, the high band can be turned off while transmitting in GSM mode. This function is not available in PIN diode modules and allows for isolation between DCS/PCS receive and the antenna to be improved by 20 dB. Additionally, the module includes SP2T/SP3T GaAs switches, a decoder for three-line control, low-pass transmit filters and diplexer. The AM108-603 is packaged in a 12-pin 6.7mm x 5.0mm x 1.7mm LGA module.

Skyworks' new antenna switch modules are available now. The AM107-602 is priced at $0.95 in quantities of 10,000. The AM108-603 is priced at $1.25 in quantities of 10,000.

Smaller, more efficient transmitter module

The Electronic Device Group of Mitsubishi Electric & Electronics USA, Inc., claims that its parent, Mitsubishi Electric Corp. and the Electronic Component Group of Kyocera Corporation have introduced the world's smallest triple-band compatible E-GSM/DCS/PCS transmitter module for cellular phone applications.

The second product in a highly integrated transmitter module family jointly developed by the two companies, the device occupies only 0.1 cubic centimeter: a 50 percent size reduction from the family's first product, introduced in July 2001. It also improves the effective power-amplifier efficiency by 5 to 8 percent, compared to a conventional power amplifier module solution.

"The newest transmitter module from Mitsubishi Electric and Kyocera achieves a higher level of integration than ever before, combining three bands in a module that is 50 percent smaller," said Bryon Gutow, senior product marketing manager for microwave and RF products at Mitsubishi. "The triple-band transmitter coverage enables cellular phone designs to be leveraged across several markets, thereby reducing development costs. In addition, the space savings enabled by the transmitter module's dramatically reduced package size permits customers to integrate more advanced components into next-generation cellular phones, so they can deliver more powerful and sophisticated functionality."

The new transmitter module attains its remarkably small size primarily through design improvements that enable an 83 percent size reduction of the RF section area, compared to traditional discrete circuitry. The transmitter module integrates an antenna switch module, RF power amplifier, and RF output power monitor coupler in the same unit, along with an EN61000-compliant electrostatic discharge (ESD) protection circuit.

The module features Mitsubishi Electric's new high efficiency InGaP HBT MMIC design and manufacturing technologies and Kyocera's high Q-factor LTCC substrate and low-loss antenna switch technologies. The module achieves power efficiency improvements on the antenna terminal of the module by combining the high-efficiency InGaP HBT MMIC, power amplifier, and low-loss antenna switch module together and optimizing the design of the antenna switch circuit and matching circuit. The power efficiency at the antenna is 43 percent for E-GSM applications and 36 percent for DCS/PCS applications. At the power amplifier, this is equivalent to a power efficiency of 60 percent for E-GSM applications and 56 percent for DCS/PCS applications. The module's high integration makes designing an external impedance-matching circuit unnecessary, thereby shortening design cycle time, saving engineering resources, and reducing product development costs.

Mitsubishi Electric and Kyocera will sample the E-GSM/DCS/PCS triple-band transmitter module in October 2002, with volume production scheduled for June 2003.

Next-generation PAs getting closer

Kopin Corporation has announced record performance results for its advanced GAIN-HBT(TM) transistor wafers. These patent-pending, wafer engineered double-heterojunction bipolar transistors (D-HBT) enable higher performance for the next generation of power amplifiers for wireless applications. Device results are published in the October 2002 issue of IEEE Electron Device Letters (Vol. 23, Issue 10, pp. 582-584), while CDMA power amplifier design cell measurement were presented at the GaAs IC Symposium in Monterey, CA, on October 23, 2002.

These advanced HBT transistors are composed of an InGaP emitter layer and a GaAs collector layer, while the base layer is composed of four elements: Ga, As, In, and N (Nitrogen). These devices enable lower voltage operation, higher DC and RF gain, and improved temperature stability compared to standard InGaP and AlGaAs HBTs. Advantages claimed for this breakthrough technology include:

- Reduced DC and RF power consumption due to lower bias voltage operation and improvements in the power added efficiency.
- Higher speed operation, with a 35% improvement in peak current-gain cutoff frequency (ft) compared to standard InGaP and AlGaAs HBTs.
- Improved linearity due to more stable DC current gain over a wider range of bias voltages and temperatures.
- Higher integration and functionality by increasing the voltage headroom for a given power supply, thereby enabling additional sub-circuitry to be inserted into wireless PAs.
- Increased IC design flexibility due to the improved temperature and bias stability and higher speeds of GAIN HBTs.
- Immediate capability with high-volume production infrastructure by using Kopin's production 4-inch and 6-inch OMCVD systems and enables "drop-in" insertion into existing circuit fabrication lines.
- Platform flexibility for further enhancements enabling Kopin's design team to engineer new features in the GAIN structure.

"Ground breaking levels of performance and integration can be obtained in power amplifiers built using Kopin's patented GAIN-HBT technology, the second generation of HBTs," stated Dr. John C. C. Fan, Kopin's founder and chief executive officer. "The enhanced speed of GAIN-HBTs also makes this technology attractive for high-speed circuit applications, especially compared with the high development and material costs of competing InP and SiGe technologies."

"Kopin has been developing GAIN-HBTs for several years," noted Dr. Roger E. Welser, Kopin's Director of Transistor Technology. "The results discussed in the October issue of the IEEE Electron Device Letters and GaAs IC Symposium papers demonstrate that GAIN-HBT technology offers significant advantages over standard InGaP and AlGaAs HBTs, and is ready for insertion into both wireless and high-speed circuit applications. These HBTs are based on GaAs platforms and are grown and fabricated similar to current HBTs."

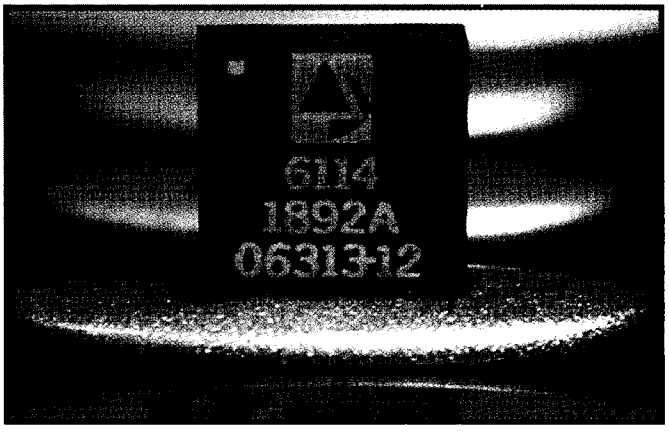
Kopin acknowledges its collaborators, Advanced Wireless Semiconductor Company (AWSC) and the University of California at San Diego (UCSD), on the IEEE Electron Device Letters paper entitled "Implementation of Reduced Turn-On Voltage InGaP HBTs Using Graded GaInAsN Base Regions," and TriQuint Semiconductor for the October 23rd presentation at the IEEE GaAs IC Symposium in Monterey, CA, entitled "Enhanced CDMA Performance from an InGaP/InGaAsN/GaAs N-P-N Double-Heterojunction Bipolar Transistor."

Production orders for Anadigics power amplifiers

Anadigics has started production shipments for new orders from a new Korean customer for its recently launched AWT6114 CDMA power amplifier. Part of a new family of 4mm by 4mm CDMA power amplifier (PA) modules, the AWT6114 meets OEM packaging requirements for smaller form factor PAs in wireless handsets. Specifically designed for the Korean KPCS band, the high linearity AWT6114 delivers higher power-added efficiency at all power levels than its predecessors, and provides greater standby and talk-times for new handsets targeting the Korean domestic wireless marketplace.

"This is further evidence of Anadigics' growing presence in the Asian CDMA handset market, as our list of CDMA customers has expanded to more than 12 handset suppliers worldwide," reports Dr. Bami Bastani, President and CEO . "The Asian CDMA sector continues to outpace the overall market and we are strategically positioned to capitalize on this growth through penetration into Korea, China, and Taiwan."

Delivering a combination of small size, efficiency and linearity, the AWT6114 power amplifier module has been developed using Anadigics' InGaP HBT technology. It is produced in a 4 x 4mm self-contained surface mount package and offers single-mode operation for all output levels which simplifies the phone software and reduces current consumption. The module also incorporates matching networks optimized for output power, efficiency and linearity in a 50-ohm system.



Anadigics has started production shipments of its new AWT6114 CDMA power amplifier.

InGaP HBT process for demanding wireless applications

Global Communications Semiconductor, Inc. (GCS) a pure-play III-V compound semiconductor wafer foundry announced today that it will now offer a proprietary High Breakdown Voltage InGaP HBT foundry process to address demanding wireless infrastructure needs such as base stations.

"With our High Breakdown Voltage process we can address the stringent requirements of infrastructure applications in terms of both performance and reliability. Until now the only other choice was PHEMT and GCS' proprietary High Breakdown Voltage InGaP HBT process allows for a more compact IC, higher yield and a superior combination of power and linearity. These are significant achievements considering the stringent requirements," commented Dr. Sam Lee, Chief Executive Officer of GCS. "This new process complements our process portfolio and enables GCS to address an even wider range of markets and customers' needs while maintaining GCS' position as the world's leading pure-play III-V compound semiconductor wafer foundry," continued Dr. Lee.

Global Communication Semiconductors Inc., based in Torrance, California, an ISO 9002 certified company, provides compound semiconductor foundry services to the wireless telecommunication and high-speed networking industries. GCS currently offers foundry services for InGaP HBT, InP HBT and PHEMT processes and provides optoelectronic foundry services for QWIP detectors, modulators & PIN diodes used in the surveillance, security and fiber optic communication markets.

PA boosts WLAN efficiency and range

RF Solutions, Inc, .a fabless supplier of Wireless Local Area Network (WLAN) semiconductor products, claims that its RFS P2020 power amplifier has the WLAN industry's highest efficiency and range for 802.11b and g (draft) products.

The multimode P2020 is a high-performance InGaP HBT integrated circuit simultaneously optimized for maximum performance in the 802.11b and 802.11g modes. It maintains its high efficiency with on-chip self-regulating dynamic power control, eliminating the need for external control circuitry to regulate current consumption. The result is maximum efficiency at both low and high power levels in 11b and 11g modes thereby greatly extending system battery life.

Considered the "workhorse" of the 802.11b/g market, the P2020 enables the highest average output power at the lowest current level in the industry ensuring maximum range at maximum data rates. The P2020 is also equipped with a sleep mode feature limiting the current consumption to less than 1 μA when the power amplifier is not in use.

Designed to integrate with WLAN transceiver chipsets, it is housed in a small 3x3mm LPCC package and operates from a single 3.3V power supply. With the industry's highest available power gain of 30dB, the P2020 enables reduced transceiver output power to further improve the system efficiency and extend battery life. In the 802.11b mode, the P2020 comfortably meets all Adjacent Channel Power Ratio (ACPR) requirements at an output power of +23dBm. In the 802.11g mode at a data rate of 54 Mbps and an output power of +20dBm, the P2020 has an error vector magnitude (EVM) of less than 4% and consumes 140 mA.

RFMD ships components for Sanyo handsets

RF Micro Devices, Inc. has begun high-volume production shipments of two power amplifiers (PAs) and a triple-band LNA/mixer to Sanyo for use in the new Sanyo SCP-4900 code division multiple access (CDMA) 2000 1X handset. Shipments began in the June quarter and have already reached a multi-million dollar level.

The Sanyo SCP-4900 is a dual-band, dual-mode CDMA handset featuring GPS functionality, a large, 1.7-inch full-color screen, a built-in, hands-free speakerphone and a call-screening function that enables users to listen in as the caller leaves a message. The SCP-4900 features a WAP 2.0 web browser and JAVA capabilities and provides up to 4.5 hours of talk time and/or up to 16 days of standby time. The SCP-4900 is designed to take full advantage of the advanced voice and data capabilities of PCS Vision(SM) on the enhanced Sprint Nationwide PCS Network. Sprint's PCS Vision enables customers to use their Vision-enabled PCS devices to check personal and corporate e-mail, play games with full-color graphics and polyphonic sounds and browse the Internet wirelessly with speeds comparable to a home computer's dial-up connection.

Bob Bruggeworth, president of RF Micro Devices, said, "These shipments complement ongoing sales of power amplifiers and small signal devices to Sanyo, a global technology leader. We value our long-standing relationship with Sanyo and look forward to supplying components into additional Sanyo phones in the future. These additional shipments to Sanyo support our goals to increase PA market share while expanding our dollar content in wireless handsets through increased sales of small signal devices."

The SCP-4900 contains the RF2496 tri-band, quad-mode (CDMA cellular/PCS/AMPS/GPS) capable LNA/mixer and is manufactured on silicon germanium (SiGe). The handset also includes two linear power amplifiers - the RF2192 (900 MHz) and RF5154 (1900 MHz) - both of which are manufactured on gallium arsenide (GaAs) heterojunction bipolar transistor (HBT).